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result should be given in the corrected form which was accepted by Joule after Rowland's exhaustive experiments in Baltimore. Joule's equivalent is now quite generally quoted as 427 rather than 424 kilogram-meters at ordinary laboratory temperature.

The difficulty of conveying clear ideas without mathematical methods is particularly felt in the attempt to define elasticity and to employ this word intelligibly in the formula for the velocity of propagation of a wave. To say that this velocity varies as the square root of the quotient of elasticity by density conveys no idea, unless modulus of elasticity has been previously defined and abundantly illustrated. The ordinary student regards india-rubber, a highly compressible solid, as the type of elasticity, while in reality its modulus of elasticity is exceptionally small. The stretch modulus is defined in an appendix to the present volume; but it is not concerned in the propagation of a sound wave through air, and it is in this connection that the formula is given. To account for the high velocity of sound in solids and liquids by reference to their superior incompressibility is inadequate unless the relation between compressibility and the volume modulus of elasticity has been already made plain. The elementary student has scarcely any alternative but to memorize words in this connection, and to trust to the future for the ideas they are intended to convey, however faithful the author of the text-book may have been to put into English what is always beyond the youthful reader.

The presentation of the subject of electric potential is unusually well given; it is, indeed, as good as could possibly be expected without mathematics. The general treatment of electricity is clear and up to date, several pages being devoted to X-rays and the phenomena of alternating currents of high potential and high frequency.

The book is not free from typographical errors, but these are in no case serious. There are occasional statements of minor importance to which exception may be taken, but the author is generally accurate and reliable, and his skill in the art of presentation is unquestioned. Among the welcome features are wood-cut reproductions of the portraits of Archimedes,

Galileo, Newton, Franklin, Faraday and Lord Kelvin.

W. LE CONTE STEVENS.

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*Leçons de chimie physique.* Professées à l'Université de Berlin. Par J. H. VAN'T HOFF, Membre de l'Académie des Sciences de Berlin, Professeur ordinaire à l'Université, et Directeur de l'Institut de Physique de Charlottenburg. Translated from the German by M. CORVISY, Professeur agrégé au Lycée de Saint-Omer. Première partie. *La Dynamique Chimique.* Librairie Scientifique. Paris, A. Hermann. 1898.

This work, as the title implies, is a translation of Van't Hoff's 'Vorlesungen über theoretische und physikalische Chemie,' or of that part of it which has thus far appeared—Chemical Dynamics. The book, as the author states, "is based upon the lectures which I give at the University of Berlin, on 'Selected Chapters in Physical Chemistry.' Indeed, it contains more than these lectures, since, in the limited time at my disposal, I was able to take up only some of the more important points, in order to cover the entire field in one lecture a week during four semesters." The method of treatment is that adopted by Lothar Meyer in the later editions of his 'Modern Theories of Chemistry.' The whole subject is treated under the general heads of Statics and Dynamics; Statics dealing with homogeneous substances, with views as to the structure of matter, with the molecular and atomic conception, and with the determination of constitution; Dynamics, with the reciprocal transformation of several substances, with affinity, reaction, velocity and chemical equilibrium. A third part is added, on the relation between physical and chemical properties and composition.

The order is, however, reversed. Chemical Dynamics, having been placed on a surer basis by thermodynamics, has acquired greater prominence, and is dealt with at the beginning. We have then: First, *Chemical Dynamics*; second, *Chemical Statics*, and third, *Relations between Properties and Composition*.

The advantage of this order is that in the first part of the work only the molecular conception enters, while the atomic hypothesis and the problem of configuration do not appear

until the second, and the problem of the relations of substance to substance, about which we still know very little, is relegated to the third and last division.

The first part, or chemical dynamics, which is now available in German and in French, treats the subject under the two general heads of *Chemical Equilibrium* and *Reaction Velocity*. We have the physical and chemical equilibria in a homogeneous substance, between two substances, between three substances, between four substances; chemical equilibrium from the molecular-mechanical standpoint; homogeneous and heterogeneous equilibria; the law of reaction velocity; reaction velocity and equilibrium; reaction velocity and affinity; mono-, bi- and tri-molecular reactions; effect of the surroundings and medium on reaction velocity; effect of temperature on the reaction velocity; effect of pressure on the reaction velocity.

The translation of this, a part of Van't Hoff's work, before the appearance of the remainder, is indicative of that esteem in which he is so justly held, not only at home, but in foreign lands. The translation into French seems to have been very carefully done, and the French edition is an inviting one, barring an occasional typographical error.

It is a matter of delight to all who are interested in physical chemistry that books are appearing simultaneously on the same chapter of their subject, from the pens of two of the great leaders in this field of work. As is well known, that portion of Ostwald's *Lehrbuch* which deals with the broad subject of *Verwandtschaftslehre* is now available in part. These two works admirably illustrate the difference in method of these two master minds, and each is enhanced in value by the other.

HARRY C. JONES.

*Laboratory Directions for Beginners in Bacteriology.* By VERANUS A. MOORE.

This book of ninety pages contains the outlines of an introductory laboratory course divided into sixty lessons, and aims to impart a technical and working knowledge of the more essential bacteriological methods and to develop a definite knowledge of a few important species of bacteria. The book is not intended to re-

place the text-book on bacteriology, but to be a manual for use at the laboratory desk in which through a series of carefully selected exercises the student, without waste of time, will cover the necessary ground.

A manual such as this represents strongly in its selections and in the amount of time allotted to each subject the personal opinions of its author, yet we believe on the whole the judgment of the writer will be approved by teachers.

This book will be found very useful by teachers who have not the time to prepare and print their own outlines. Even those who are compelled to give a course much shorter than that sketched in this book can easily, without serious harm, reduce the length of the course by omitting the practical work in some of the chapters and shortening it in others. The classification of the bacteria upon the system of Migula seems to us a mistake, for it necessitates many changes in the accustomed nomenclature; thus the name bacillus is limited to motile rod-shaped organisms to which the flagella are attached to all parts of the body. A bacillus with polar flagella becomes a pseudo-monas and one without any flagella a bacterium. As this book is intended to be used along with various text-books on bacteriology, it would seem wiser to have omitted any elaborate and unusual classification which, however valuable, must of necessity frequently clash with that used in the text-book, and thus tend to confuse the student.

WM. H. PARK.

#### GENERAL.

THE U. S. Department of Agriculture has issued a bulletin on Fish as Food (*Farmers' Bulletin*, No. 85), by Dr. C. F. Langworthy, of the Office of Experiment Stations, in which the results of investigations on the nutritive value of various kinds of sea food have been summed up for the general reader. The chemical composition of a considerable number of fresh and preserved fishes, mollusks, crustaceans, etc., are given; the relative cost of protein and energy in fish and other food material is shown; the place of fish in the diet is discussed, and some sample menus are given to show how fish may be combined with other food materials to make a well-balanced dietary. The popular notion